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Department of Energy
Richland Operations Office
P.O. Box 550
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MAY 4 2001

01-GWVZ-019

July - Dec 2000

Ms. Jane Hedges
Cleanup Section Manager
Nuclear Waste Program
State of Washington
Department of Ecology
1315 W. Fourth Avenue
Kennewick, Washington 99336

Dear Ms. Hedges:

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) FINAL STATUS/
CORRECTIVE ACTION SEMIANNUAL REPORTS

Please find attached the semiannual reports for two RCRA sites (the 183-H Solar Evaporation Basins [Attachment 1] and 300 Area Process Trenches [Attachment 2]) where groundwater is monitored under Final Status/Corrective Action programs. These reports are submitted to fulfill the requirements of WAC 73-303-645(11)(g).

If you want to discuss this matter further or require additional information, please contact Marvin J. Furman at (509) 373-9630.

Sincerely,

John G. Morse

John G. Morse, Program Manager
Groundwater/Vadose Zone Project

GWVZ:MJF

Attachments

cc w/attachs:
R. L. Biggerstaff, BHI
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Attachment 1

Results of Groundwater Monitoring for RCRA Corrective Action at the 183-H Solar Evaporation Basins August through December 2000

M.J. Hartman
April, 2001

INTRODUCTION

The 183-H solar evaporation basins were located in the 100 H Area of the Hanford Site, and have been demolished and backfilled. The site is regulated under the *Resource Conservation and Recovery Act of 1976* (RCRA). The waste discharged to the basins originated in the 300 Area fuel fabrication facility and included solutions of chromic, hydrofluoric, nitric, and sulfuric acids that had been neutralized. The waste solutions contained various metallic and radioactive constituents (e.g., chromium, technetium-99, uranium). Between 1985 and 1996, remaining waste was removed, the facility was demolished, and the underlying contaminated soil was removed and replaced with clean fill.

This is the third of a series of reports on corrective action monitoring at the 183-H Solar Evaporation Basins. It addresses requirement of WAC 173-303-645(11)(g) to report twice each year on the effectiveness of the corrective action program. This report covers the period from August through December 2000.

The Washington State Department of Ecology issued a RCRA Permit for the Hanford Site in 1994 (Ecology 1994). The 183-H Basins were included in Part V of the Permit, which contains requirements specifically applicable to those treatment, storage, and disposal units that are undergoing closure. A final-status, compliance monitoring program was proposed in 1995 (Hartman and Chou, 1995) to comply with the groundwater monitoring requirements of WAC 173-303-645.

The first sample set collected during compliance monitoring showed that downgradient concentrations of the contaminants of concern exceeded concentration limits defined in the monitoring plan. The regulations require corrective action activities to reduce contaminant concentrations in groundwater. The Postclosure Plan, which was incorporated into Part V of the Hanford Site RCRA Permit in February 1998, deferred corrective action to the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) interim action for in the 100-HR-3 Operable Unit. The Postclosure Plan also required monitoring to be conducted as described in the revised RCRA groundwater monitoring plan (Hartman 1997).

The objective of RCRA groundwater monitoring during the period of interim remediation is to track trends in chromium, nitrate, uranium, technetium-99, and fluoride. DOE, the regulators, and members of the public will determine methods for final remediation of 100-H Area groundwater some time in the future. At that time, the RCRA monitoring program will be revised to meet the requirements of final remedial measures.

INTERIM REMEDIAL MEASURE

The interim remedial measure applies to the 100-HR-3 groundwater operable unit, which is under the authority of a CERCLA record of decision. Groundwater is pumped from five extraction wells, located west, north, and east of the 183-H Basins (Figure 1). The effluent is treated to remove chromium and injected back into the aquifer in upgradient wells. The objective of the interim remedial measure is to reduce the amount of chromium entering the Columbia River, where it is a potential hazard to the ecosystem.

Groundwater is sampled to monitor the effectiveness of the interim remedial measure and to monitor the entire 100-HR-3 Operable Unit (DOE-RL 1996; Peterson and Raidl, 1996). This CERCLA monitoring is coordinated with RCRA monitoring.

The pump-and-treat system may be shut down when concentrations of hexavalent chromium are below 22 μg/L in wells specified in the ROD and data indicate that the concentration will remain below that value. The system may also be shut down if the system proves ineffective or if a better treatment technique is found. The most recent operable unit report, covering calendar year 1999, concluded that chromium concentrations in groundwater were declining but are not consistently below 22 μg/L in compliance wells (DOE-RL, 2000).

RCRA GROUNDWATER MONITORING PROGRAM

Four wells located in the 183-H chromium plume are monitored for RCRA requirements during pump-and-treat activities (see Figure 1). Three of the wells are completed at the top of the uppermost aquifer (Hanford formation): wells 199-H4-7 and 199-H4-12A are extraction wells, and well 199-H4-3 is a monitoring well that has historically shown the highest levels of chromium, nitrate, technetium-99, and uranium from the 183-H Basins. Well 199-H4-12C is located adjacent to 199-H4-12A and is completed in a confined aquifer in the Ringold Formation. This well consistently has elevated concentrations of chromium, though the contaminant source is unknown. This well is monitored to help determine whether pumping the shallow aquifer affects chromium concentrations deeper in the Ringold sediments.

Wells are sampled annually for RCRA, generally in November. This is typically a period when river stage is low and the samples reflect nearly pure groundwater instead of a mixture of groundwater and river water held in bank storage. Therefore, contaminant concentrations in November are usually among the highest of the year.

Hartman and Chou (1995) listed the following concentration limits for the 183-H Basins constituents of concern:

- Chromium: 122 µg/L. This limit was derived based on background concentrations from upgradient wells 199-H3-2A and 199-H4-6, which were formerly monitored for RCRA.

- Nitrate: 45 mg/L (as NO_3). Based on final maximum contaminant level (56 FR, January 30, 1991).

- Uranium: 20 µg/L. Based on EPA proposed changes to 40 CFR 141.

- Technetium-99: 900 pCi/L. Interim drinking-water standard, based on national primary drinking water standards (40 CFR 141).

Hartman and Chou (1995) did not identify fluoride as a groundwater contaminant of concern, but it was detected in the vadose zone beneath the former basins and so it is monitored under RCRA (DOE-RL, 1997).

During the period of compliance monitoring (1995-1996), contaminant concentrations from compliance wells were compared to the concentration limits listed above to determine whether corrective action was necessary as required under WAC 173-303-645. Because the CERCLA pump-and-treat system is not the final corrective action for the site, the current objective of RCRA monitoring is simply to track trends, not to determine the effectiveness of the corrective action (Hartman 1997). After completion of the interim remedial measure and future phases of corrective action, the RCRA monitoring program will be revised and contaminant concentrations will be compared to applicable standards to determine whether the final corrective action was successful.

CONTAMINANT TRENDS

This section discusses concentrations of chromium, fluoride, nitrate, technetium-99, and uranium in groundwater. Data for the reporting period (August through December 2000) are included in Table 1. The wells are sampled for the objectives of CERCLA as well as for RCRA. All available data are presented in the table and pertinent results are discussed below.

Concentrations of groundwater contaminants fluctuate seasonally, especially in wells 199-H4-3 and 199-H4-12A. These two wells are directly in the contaminant plume from the 183-H basins and are relatively near the Columbia River. Changing river stage causes the water table to rise and fall. In general, a low water table is associated with higher concentrations of contaminants. Seasonal variations in the water table also cause changes in the direction of groundwater flow. Since 1998, overall contaminant trends have been downward.

Chromium

Chromium concentrations in the four RCRA monitoring wells are illustrated in Figure 2, which includes two types of analyses: total chromium and hexavalent chromium. Total chromium may include the relatively insoluble, nontoxic trivalent chromium and the soluble, more toxic hexavalent form. Filtered samples represent dissolved chromium, which is assumed to be hexavalent. Samples analyzed for hexavalent chromium may be filtered or unfiltered. Table 1 indicates which types of analyses were run and which samples were filtered.

Well 199-H4-3 detected the highest chromium concentration at the top of the aquifer (112 µg/L hexavalent) during the reporting period. The concentration in November 2000 was lower than in the fall of 1998 or 1999, and appears to fit the pattern of an overall decline. Chromium concentrations in extraction wells 199-H4-7 and 199-H4-12A continued to be lower than in well 199-H4-3. Concentrations in well 199-H4-7 have been declining gradually for the past 10 years, except for a peak in 1998. Concentrations in well 199-H4-12A are variable because the well is close to the Columbia River and the water table fluctuates. Concentrations ranged from 2.6 µg/L in August 2000 to 64 µg/L in November 2000 in this well.

Well 199-H4-12C is completed in a confined aquifer in the Ringold formation. Chromium concentrations were higher than in any of the shallower wells in November 2000 (160 µg/L hexavalent). The source of the chromium in this deeper aquifer is unknown, but is probably not the 183-H basins because concentrations of technetium-99, uranium, and nitrate are low. Chromium levels have been declining since 1996 (i.e., before the pump-and-treat system began to operate).

Fluoride

Fluoride concentrations were in the hundreds of µg/L during the reporting period, typical values for the past several years (Figure 3). These levels are about the same as in wells that are upgradient of the 183-H basins, and are all far below the 4,000 µg/L maximum contaminant level.

Nitrate

Nitrate concentrations were highest in well 199-H4-3 in November, at 120 mg/L. This is a much lower level than the year before (380 mg/L), but an overall trend is difficult to discern because concentrations are highly variable (Figure 4). Nitrate concentrations also were fairly high in extraction wells 199-H4-7 and 199-H4-12A, at 43 and 69 mg/L, respectively, in November 2000. A spike in nitrate in well 199-H4-7 in July 1997 appears to be related to similar increases in uranium and technetium-99. The fact that spikes occurred in all three of these contaminants indicates they were probably not erroneous values, but the cause of the brief peak is unknown. Deep well 199-H4-12C had a low nitrate concentration in November 2000 (5.4 mg/L).

Technetium-99

All of the RCRA wells showed fairly low technetium-99 concentrations in November 2000 (Figure 5). Well 199-H4-3, as usual, had the highest concentration (272 pCi/L). This was a much lower level than a year before (1,070 pCi/L), but an overall trend is difficult to define because concentrations have ~~been highly~~been highly variable over the past 10 years. Concentrations in extraction wells 199-H4-7 and 199-H4-12A were undetected and 114 pCi/L, respectively, in November 2000. Deep well 199-H4-12C had no detectable technetium-99.

Uranium

Trends in uranium concentrations are very similar to technetium-99 in all four RCRA monitoring wells (Figure 6).

CONCLUSIONS

The current objective of RCRA monitoring is simply to track trends, not to determine the effectiveness of the corrective action. After completion of the interim remedial measure and future phases of corrective action, the RCRA monitoring program will be revised and contaminant concentrations will be compared to applicable standards to determine whether the final corrective action was successful.

Contaminant concentrations during August through December 2000 continued previous trends. Concentrations are highest in well 199-H4-3, immediately downgradient of the former 183-H basins. Specific observations include the following:

- Chromium concentrations continued their general decline in wells 199-H4-3, 199-H4-7, and 199-H4-12C. Well 199-H4-12A has a variable trend because of water table fluctuations.

- Fluoride concentrations are low downgradient and upgradient of the basins.

- Nitrate, technetium-99, and uranium trends were similar to one another. Well 199-H4-3 had the highest concentrations, but levels were much lower than the previous year. Trends are variable in extraction well 199-H4-12A, and levels were slightly higher than a year ago. Trends in extraction well 199-H4-7 and deep well 199-H4-12C were steady or gently declining.

The four RCRA wells will be sampled for all of the constituents of interest in November 2001. The CERCLA program samples the extraction wells quarterly and wells 199-H4-3 and 199-H4-12C semiannually. The current RCRA monitoring plan (Hartman 1997) remains adequate for the objective of tracking trends during the period of the interim remedial action.

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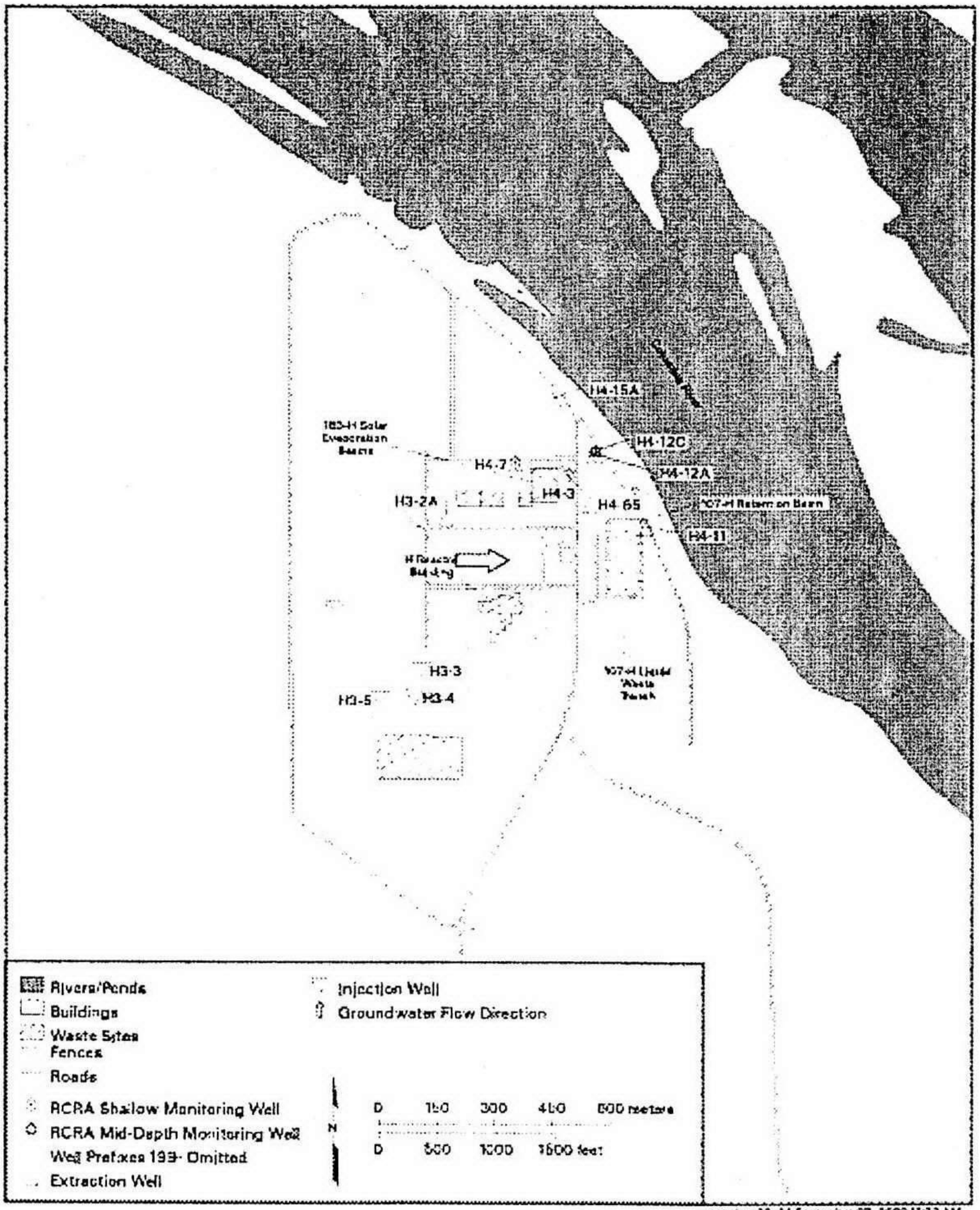

Figure 1. Monitoring Well Locations for 183-H Solar Evaporation Basins.

Table 1. Constituents of Interest for RCRA Groundwater Monitoring at 183-H Solar Evaporation Basins, August through December 2000.

Well	Date	Result	Filtered	Qualifier	Chromium analysis
Chromium, ug/L					
199-H4-12A	8/7/00	60	N		Hexavalent
199-H4-12A	8/16/00	28	N		Hexavalent
199-H4-12A	8/23/00	2.6	N		Hexavalent
199-H4-12A	11/13/00	77	N		Hexavalent
199-H4-12A	11/14/00	63.8	Y		ICP metals (total chromium)
199-H4-12C	11/7/00	160	Y		Hexavalent
199-H4-12C	11/7/00	147	Y		ICP metals (total chromium)
199-H4-12C	11/7/00	156	N		ICP metals (total chromium)
199-H4-3	11/13/00	131	N		ICP metals (total chromium)
199-H4-3	11/13/00	112	Y		Hexavalent
199-H4-3	11/13/00	110	Y		ICP metals (total chromium)
199-H4-7	8/7/00	47	N		Hexavalent
199-H4-7	8/16/00	50	N		Hexavalent
199-H4-7	8/23/00	28	N		Hexavalent
199-H4-7	11/13/00	44	N		Hexavalent
199-H4-7	11/14/00	45.7	Y		ICP metals (total chromium)
Fluoride, ug/L					
199-H4-12A	11/14/00	210	N		Not applicable
199-H4-12C	11/7/00	500	N	U	Not applicable
199-H4-3	11/13/00	500	N	U	Not applicable
199-H4-7	11/14/00	260	N		Not applicable
Nitrate, mg/L					
199-H4-12A	11/14/00	69	N	D	Not applicable
199-H4-12C	11/7/00	5.4	N		Not applicable
199-H4-3	11/13/00	120	N		Not applicable
199-H4-7	11/14/00	43	N	D	Not applicable
Technetium-99, pCi/L					
199-H4-12A	11/14/00	114	N		Not applicable
199-H4-12C	11/7/00	-5.14	N	U	Not applicable
199-H4-3	11/13/00	272	N		Not applicable
199-H4-7	11/14/00	6.87	N	U	Not applicable
Uranium, ug/L					
199-H4-12A	11/14/00	15.8	N		Not applicable
199-H4-12C	11/7/00	1.64	N		Not applicable
199-H4-3	11/13/00	49.3	N		Not applicable
199-H4-7	11/14/00	3.16	N		Not applicable
D = Sample was diluted before analysis. Reported value is corrected.					
U = Analyte was analyzed for but not detected at or above the statistically adjusted method detection limit or instrument detection limit.					

Attachment 2

Results of Groundwater Monitoring for RCRA Corrective Action
at the 300 Area Process Trenches
July through December 2000
April 2001

INTRODUCTION

The 300 Area Process Trenches (316-5) were operated to receive effluent discharges of dangerous mixed waste from fuel fabrication laboratories in the 300 Area. This is the third of a series of semiannual groundwater-monitoring reports on the corrective action program at the 300 Area Process Trenches. It fulfills requirements of WAC 173-303-645(11)(g) to report on the effectiveness of the corrective action program. Results of monitoring have been reported previously in groundwater annual reports (e.g., Hartman et al. 2000, Hartman et al. 2001). This report covers groundwater monitoring data collected during the period from July through December 2001.

BACKGROUND

A RCRA interim-status groundwater quality assessment program began in June 1985 to monitor groundwater near the 300 Area Process Trenches and continued until December 1996. In December 1996, the interim-status assessment program was changed to a final-status compliance-monitoring program. The schedule for modifying the Hanford Site RCRA Permit (Ecology 1994) required that a modified closure plan and accompanying revised groundwater-monitoring plan be submitted. The documents were prepared, and the closure plan (DOE/RL-93-73) included the revised groundwater-monitoring plan (Lindberg et al. 1996). This documentation is referenced in the revised Hanford Site RCRA Permit (Ecology 1994) and became effective December 26, 1996.

As expected, groundwater samples from well 399-1-16B, a downgradient well sampling the base of the uppermost aquifer, showed that cis-1,2-dichloroethene (cis-DCE) and trichloroethene (TCE) were in concentrations higher than the specified concentration limits (70-µg/L and 5-µg/L Maximum Contaminant Levels [MCLs], respectively). Similarly, the three downgradient wells monitoring the aquifer at the water table (399-1-10, -1-16A, and -1-17A) had concentrations of uranium that exceeded the 20-µg/L EPA-proposed MCL. After the first four independent samples were collected in December 1996, and January, February, and March 1997, the exceedances of MCLs for cis-DCE, TCE, and uranium were confirmed and the regulator was notified. As required by WAC 173-303-645(2)(a)(ii), the monitoring plan was modified to change from a compliance-monitoring plan to a corrective action plan.

The objective of groundwater monitoring during the corrective action period is to demonstrate the effectiveness of the corrective action program by examining the trends of the constituents of interest to confirm that they are attenuating naturally, as expected by the CERCLA record of decision for the 300-FF-5 Operable Unit (ROD 1996). The proposed groundwater-monitoring plan for corrective action ~~utilizes~~will utilize the same well network that was being sampled during the compliance period but ~~uses~~will use the combined Shewhart-CUSUM approach for statistical evaluations. This approach can be implemented with a single observation (sample) at any monitoring event. The method could be applied to monitor each well individually and yet maintain desired site-wide false-positive and false-negative rates. Also, each well showing an exceedance of one of the constituents of interest (currently, four of eight wells) will be put on a quarterly sampling schedule to better follow the trends of contaminant concentration. The other wells in the network will continue to be sampled semiannually. The proposed methodology was reviewed and accepted recently by the regulator, and work has begun to revise the corrective action groundwater monitoring plan.

RCRA GROUNDWATER-MONITORING PROGRAM

Until the time that the revised corrective action plan is approved by the regulator, the current final-status compliance-monitoring program (Lindberg et al. 1996) will remain in effect. This current compliance-monitoring plan requires that four independent (time independent) groundwater samples from each network well (eight) be collected during each semiannual sampling period (i.e., 64 well trips/yr = 8 wells x 4 well trips/semiannual sampling period x 2 sampling periods/yr). The groundwater-monitoring well network is sampled in the following months: December, January, February, March (when the Columbia River stage is generally low), and June, July, August, and September (when the Columbia River is generally higher. The current reporting period includes January, February, March, and June. Time independence is accomplished by sampling at one-month intervals during each semiannual sampling period. The revised corrective action plan will accomplish the goals of the original final-status/compliance-monitoring program but with one independent sample collected during each semiannual sampling event.

The groundwater-monitoring well network for the 300 Area Process Trenches includes four well pairs (Figure 1). One pair is upgradient and three pairs are downgradient. Each well pair is composed of one well that monitors the upper portion of the uppermost aquifer near the water table (wells ending in "A"), and another well that monitors the base of the uppermost aquifer (wells ending in "B").

Wells in the network are monitored for constituents of interest including uranium and volatile organics. The concentration limits, as specified in Lindberg et al. (1996), are as follows:

- Uranium: 20 μg/L (interim-proposed). [Note: Effective December 8, 2003, the MCL for uranium will be 30 μg/L (40 CFR Parts 9, 141, and 142).]
- Cis-1,2-dichloroethene: 70 μg/L. Based on MCL.
- Trichloroethene: 5 μg/L. Based on MCL.
- Any other volatile organic detected: MCL.

CONTAMINANT TRENDS

This section discusses concentrations of uranium, cis-DCE, and TCE in groundwater near the 300 Area Process Trenches. Data for the reporting period (July through December 2001) are included in the attachment. [Note: As scheduled, groundwater samples were to be *collected during the months of July, August, September, and December 2000. Due to sampling* delays, groundwater samples were not collected during July and December 2000. Therefore, the only data available for the reporting period are from groundwater samples collected during August and September 2000.] Reported results are compared to the concentration limits defined above. For more information on groundwater contamination near the 300 Area Process Trenches, as well as the whole 300 Area since December 1997, see Hartman and Dresel (1998), Hartman (1999), Hartman et al. (2000), and Hartman et al. (2001).

Uranium

Uranium-contaminated groundwater in the 300 Area (Figure 2) occurs mostly near the top of the uppermost aquifer. Although uranium is distributed throughout much of the 300 Area, wells downgradient for the majority of the time (southeast) of the southern end (the discharge end) of the 300 Area Process Trenches are associated with some of the highest concentrations of uranium in the 300 Area. Based on this distribution, the soil beneath (or near) the 300 Area Process Trenches continues to be one of the major sources of uranium contamination in groundwater.

The concentration of uranium remained above the concentration limit (20 μg/L) during the reporting period in the three downgradient wells of the well network (Figures 3, 4, and 5) that are screened in the upper portion of the uppermost aquifer (399-1-10A, -1-16A, and –1-17A). It was also detected in well 399-1-18A (an upgradient well) at a concentration 5.96 μg/L. The reported result of 129.0 μg/L (Aug. 1, 2000) in well 399-1-16A is part of a slightly rising trend. The result in well 399-1-10A (50.9 μg/L on Aug. 1, 2000) is about the same as previous results since 1999. For well 399-1-17A, the result of 99.0 μg/L in Aug. 1, 2000, is part of a steady to slightly decreasing trend.

In the downgradient wells screened in the lower portion of the uppermost aquifer, uranium was not detected in well 399-1-17B. However, it was detected in wells 399-1-10B (0.17 μg/L) and 399-1-16B (10.8 μg/L) but remained below the interim-proposed concentration limit. The reported result of 10.8 ug/L at well 399-1-16B is part of a rising trend.

The overall trend for uranium near the process trenches is that the peak (or highest concentration) of the plume is moving downgradient in the uppermost part of the uppermost aquifer in response to the dominant groundwater flow direction. At the same time the plume is spreading laterally and into the lower portions of the uppermost aquifer near the process trenches.

Chlorinated Hydrocarbons

None of the wells in the 300 Area Process Trenches well network had reported concentrations of TCE above the 5.0 μg/L MCL during the reporting period. The highest reported concentration was 2.3 μg/L in August of 2000 in well 399-1-16B (Figure 6). Other wells of the network occasionally have detectable concentrations of TCE, but none higher than 0.37 μg/L. Since March 1997 the reported concentrations of TCE have been slowly declining in 300 Area Process Trenches network wells.

Cis-1,2-dicloroethene (DCE) is detected in two wells near the 300 Area Process Trenches (399-1-16B and 399-1-17B), but only well 399-1-16B had reported concentrations above the concentration limit (70 µg/L) during the reporting period. The highest reported concentration during that time was 160 µg/L in Sept. 2000 (Figure 7). As shown in Figure 7 the concentration of DCE in well 399-1-16B varied from 90 to 190 ug/L but overall has remained elevated since 1994..

CONCLUSIONS

Concentrations of uranium and cis-DCE exceeded applicable concentration limits during the reporting period of July to December 2000. Uranium concentrations exceeded the concentration limit at all three downgradient wells that are completed in the upper portion of the uppermost aquifer. One of the downgradient wells shows a slightly rising trend, one a steady trend, and the other a steady to slightly decreasing trend. These results indicate that the highest concentration of uranium in the plume is moving downgradient in response to the dominant groundwater flow direction. Cis-DCE exceeded applicable concentration limits in only one well (399-1-16B – screened in the lower portion of the uppermost aquifer) during the reporting period. The trend is variable and remains elevated.

The proposed statistical evaluation approach for the revised corrective action groundwater monitoring plan was approved by the regulator recently. The revised plan is being prepared and will be submitted to Ecology. Until it is approved by the regulator, the current final-status compliance-monitoring program (Lindberg et al. 1996) will remain in effect.

The draft Five-Year Review of the Hanford Site 300 Area NPL Site (U.S. EPA, 2001) indicated that, in general, the 300 Area cleanups are proceeding in a protective and effective manner. The EPA still considers the cleanup goals and remedy selection decisions in the record of decision (ROD, 1996) appropriate at the present time but outlines a number of action items.

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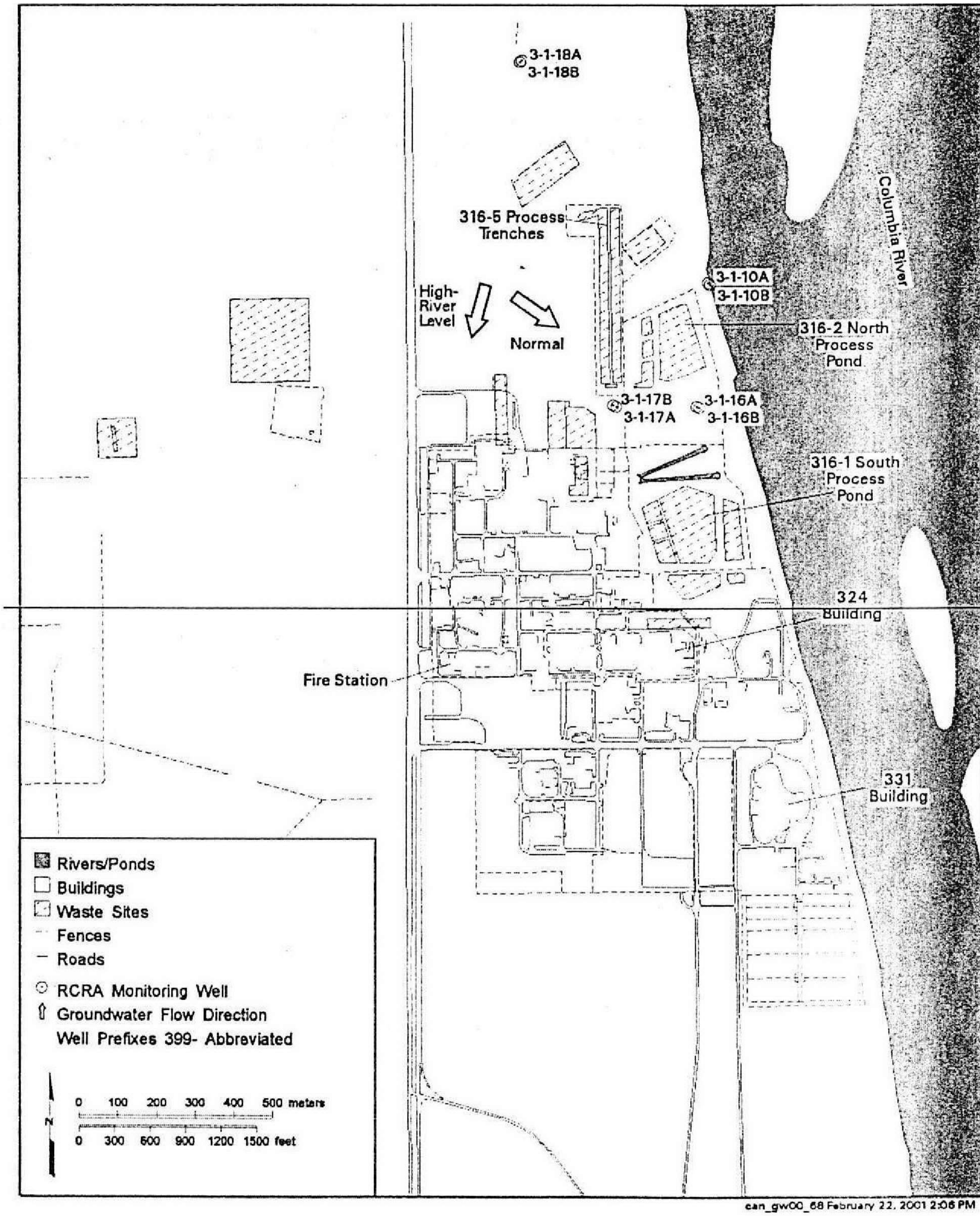
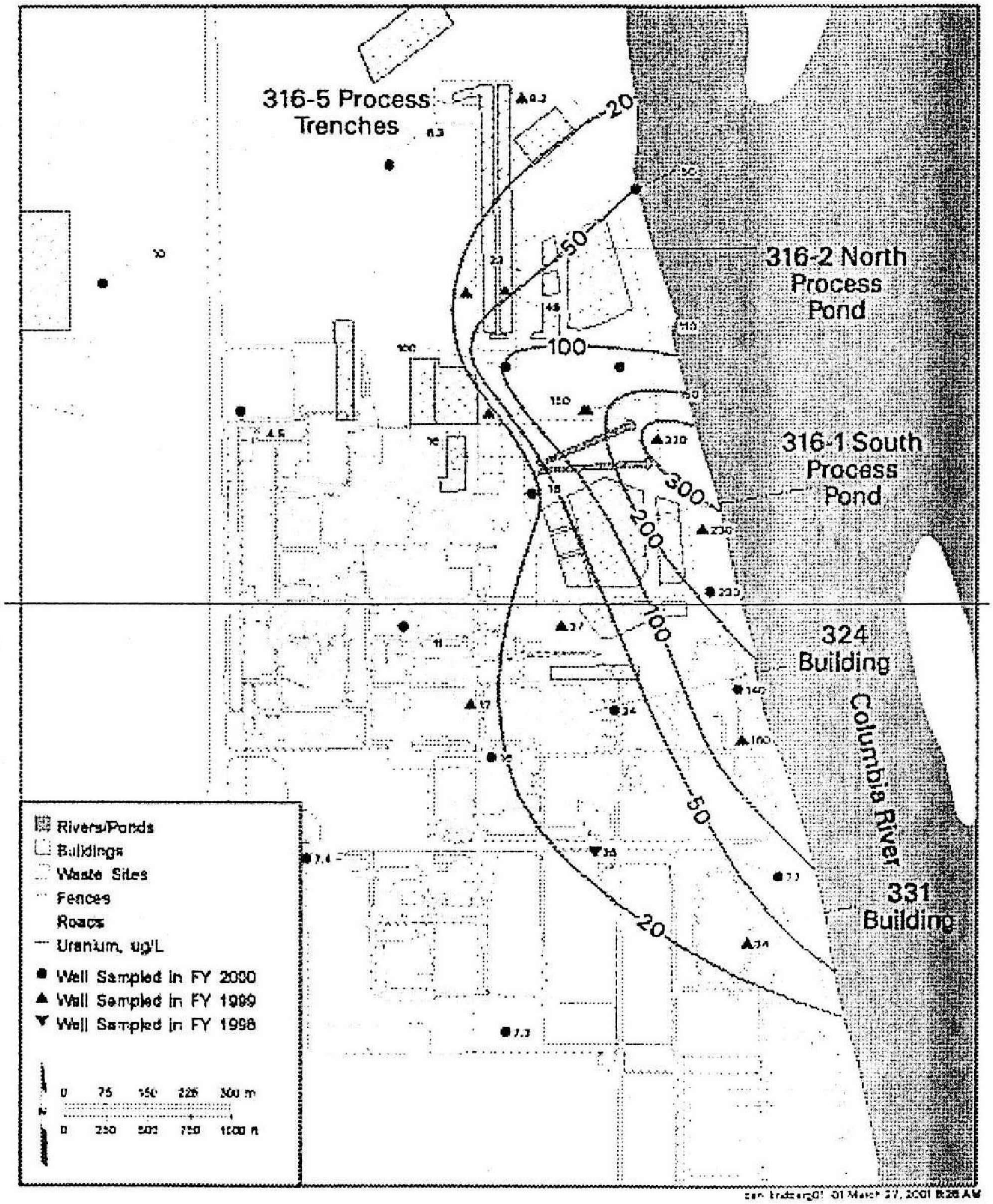


~~Figure 1. Monitoring Well Locations for the 300 Area Process Trenches.~~



~~Figure 2. Average Uranium Concentration in Groundwater at 300 Area, Fiscal Year 2000.~~